



STANFORD

SCHOOL OF
HUMANITIES AND SCIENCES



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Science, Health & Medicine,
Engineering, and Environment**

Gendered Innovations

in Science,
Health & Medicine,
Engineering, and
Environment

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What is **Gendered Innovations**?

SEX & GENDER ANALYSIS

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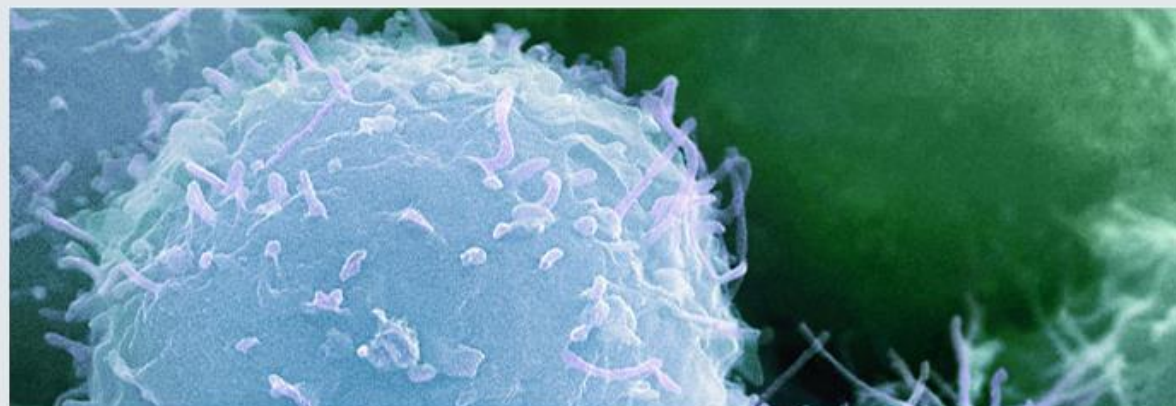
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SCIENCE

Sex and Gender Methods for Research

[Gendered Innovations](#)



SCIENCE

HEALTH & MEDICINE

ENGINEERING

ENVIRONMENT

FEATURED CASE STUDIES



**Stem Cells: Analyzing
Sex**



**Osteoporosis
Research in Men:
Breaking the Gender
Paradigm**



**HIV Microbicides:
Formulating Research
Questions & Analyzing
Academic Disciplines**

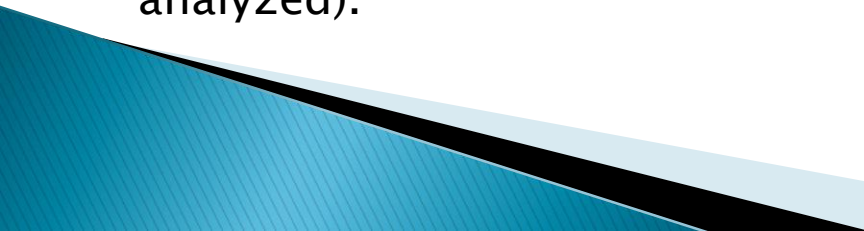
Why Gendered Innovations?

**“Gendered
Innovations”
employs methods of
sex and gender
analysis to create
new knowledge.**

Percentage of EC Horizon 2020 grants funded in 2015 that integrated sex or gender analysis into research:

▶ 36%

European Commission. Horizon 2020. Monitoring Report 2015. Directorate-General for Research and Innovation (2016), 53. (6,062 grants analyzed).



Gendered Innovations...

- ▶ Can we harness the creative power of sex & gender analysis for discovery?

THREE FIXES

1. FIX THE NUMBERS OF WOMEN
2. FIX THE INSTITUTIONS
3. FIX THE KNOWLEDGE



FIX THE KNOWLEDGE

Doing Research Wrong Costs Lives and Money

- Between 1997 and 2000, 10 drugs were withdrawn from the U.S. market because of life-threatening health effects—8 of those showed greater severity in women (GAO, 2001).

Doing Research Right Saves Lives and Money

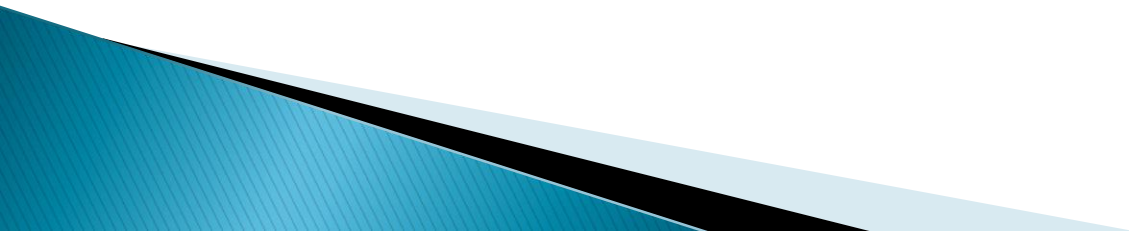
WHI Hormone Therapy Trials

- Each \$1 spent returned \$140 to US taxpayers in health care savings
- Health Improvements
 - * 76,000 fewer cases of cardiovascular disease
 - * 126,000 fewer breast cancer cases
 - * 145,000 more quality-adjusted life years
 - * However: 263,000 more osteoporotic fractures

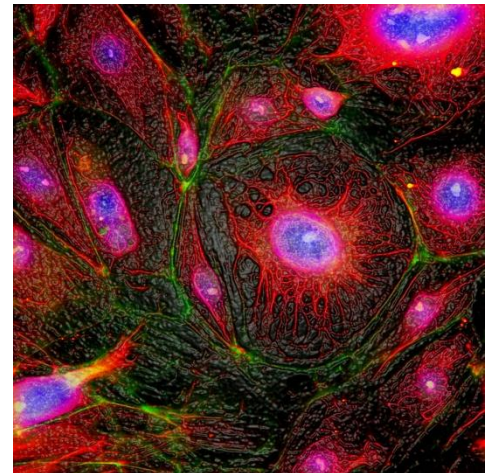
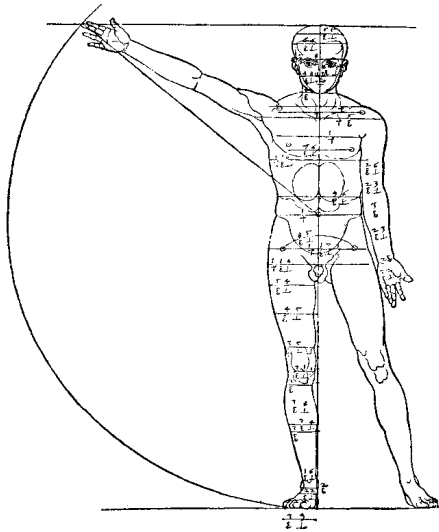
Joshua A. Roth et al., *Annals of Internal Medicine* (2014) 160, 9:594-602.

Gendered Innovations

- 1) develop state-of-the-art Methods of sex and gender analysis
- 2) provide Case Studies to illustrate how gender analysis leads to discovery and innovation.

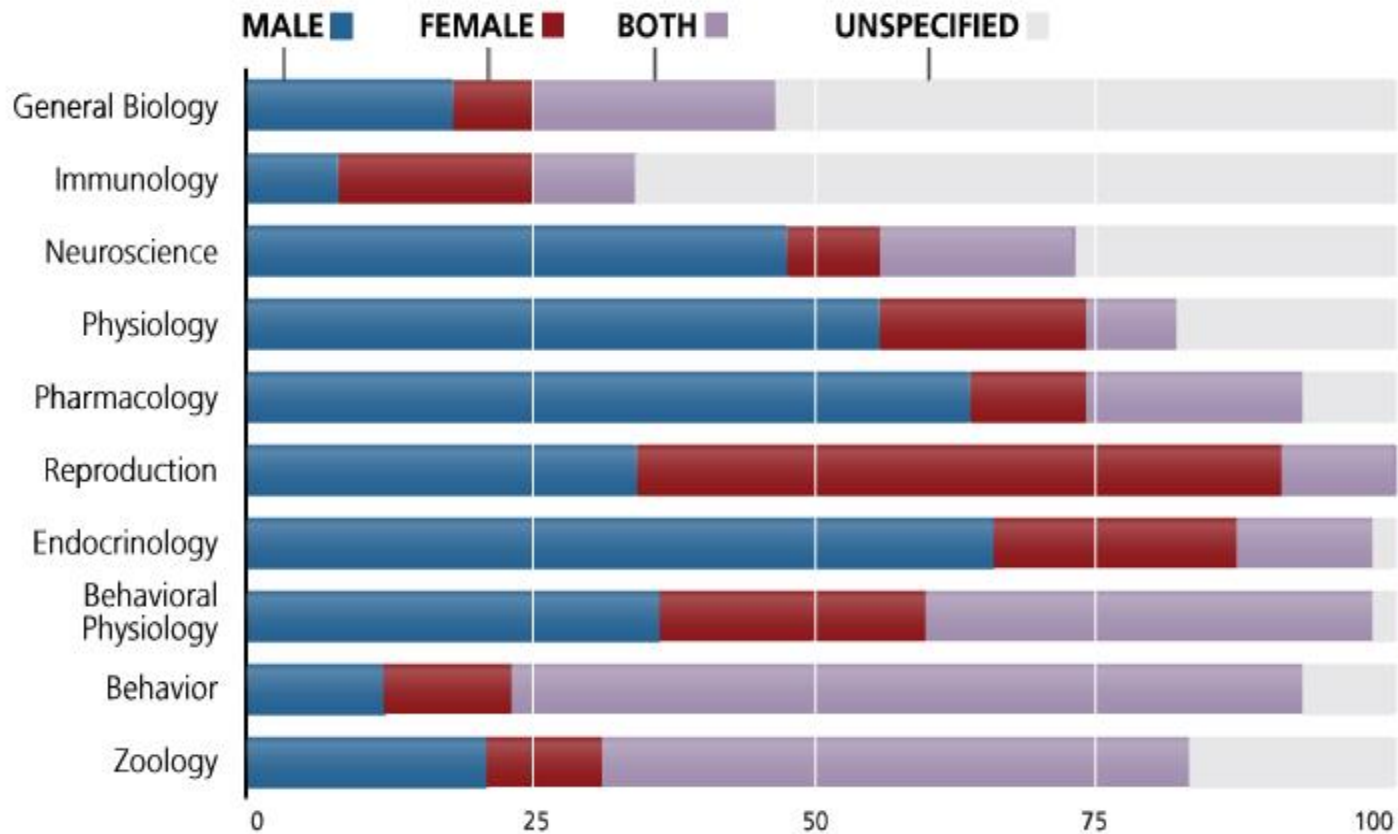


Most research is done in males



Proportion of Research Studies Using Male and/or Female Animals

From published journal articles within specified biomedical subfield, 2009

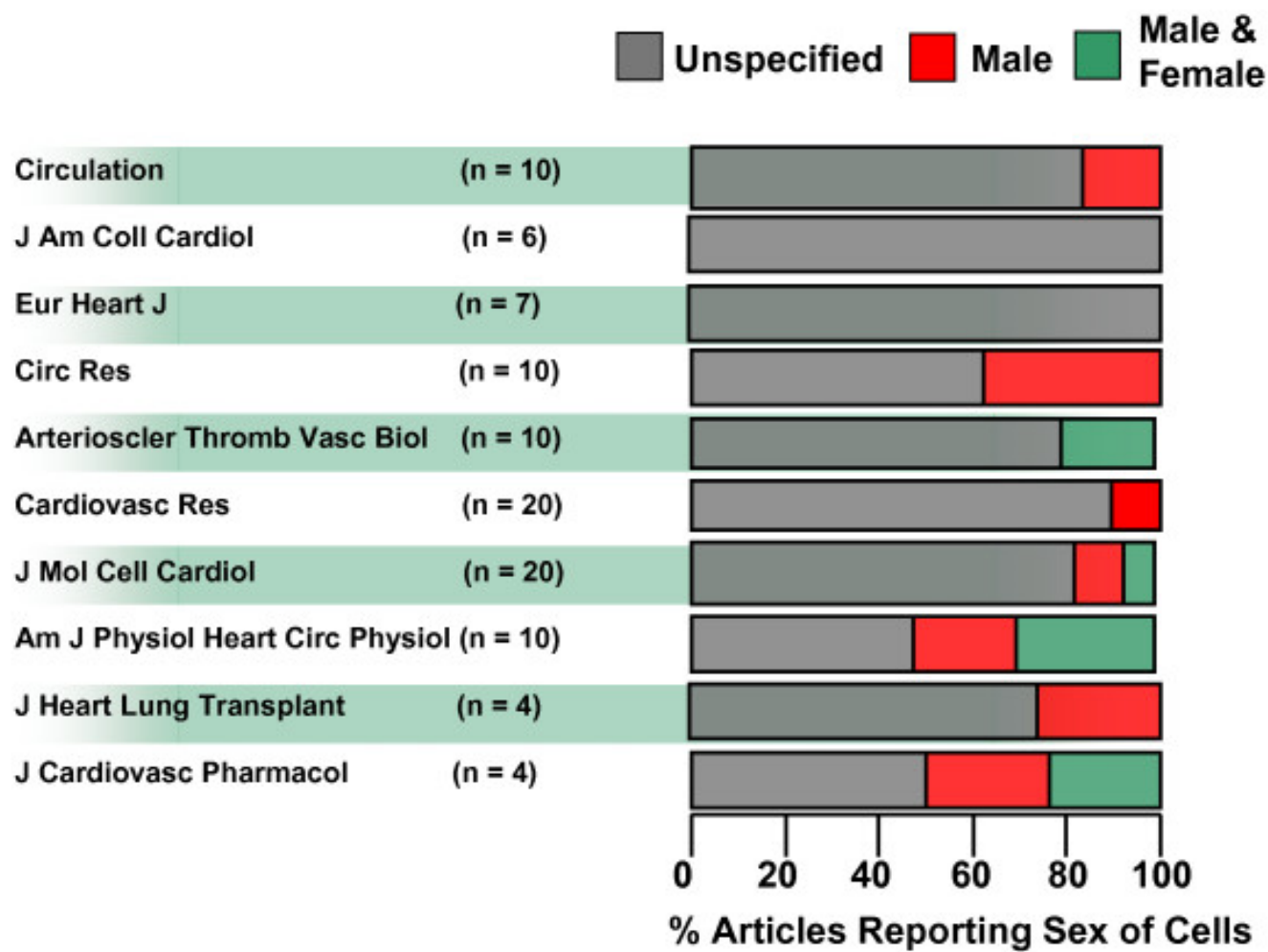


Adapted from Beery et al., 2011

Beery, A., & Zucker, I. (2011). Sex Bias in Neuroscience and Biomedical Research. *Neuroscience and Biobehavioral Reviews*, 35 (3), 565-572.

Taylor, K., Vallejo-Giraldo, C., Schaible, N., Zakeri, R., & Miller, V. (2011). Reporting of Sex as a Variable in Cardiovascular Studies using Cultured Cells. *Biology of Sex Differences*, 2 (11), 1-7.

Percentage of articles reporting sex of cells used in the experiments



Shah, K., McCormack, C. E., & Bradbury, N. A. (2014). **Do you know the sex of your cells?** *American Journal of Physiology-Cell Physiology*, 306(1), C3-C18.

Cell Line	Sex	Description	Species	Year	Origin	Reference
5637	Male	Urinary bladder epithelium	Human	1974	C	(68, 69)
3T3-L1	Male	Embryo fibroblast	Mouse	1962	N	(84, 85)
16HBE		Lung epithelial	Human		N	(46, 88)
A549	Male	Lung epithelial	Human	1972	C	(79, 137)
A6	Male	Kidney epithelial	<i>Xenopus</i>	1965	N	(165,222)
A7r5		Aorta smooth muscle	Rat	1976	N	(15, 183)
AGS	Female	Stomach epithelial	Human	1979	C	(10, 11)
AML-12	Male	Liver epithelial	Mouse	1994	N	(61, 282)
AML-193	Female	Lymphoblast	Human	1987	C	(131,229)
ARPE-19	Male	Retinal pigmented epithelial	Human	1986	N	(62, 101)
BeWo	Female	Placenta	Human	1966	N	(193,194)
BHK		Kidney fibroblast	Syrian hamster	1961	N	(146,148) . . .

15-Year Outcomes for Heart Transplant

Years post-HT	MD-MR (n=40,497) Mean Survival %	FD-MR (n=13,480) Mean Survival %	MD-FR (n=6,436) Mean Survival %	FD-FR (n=7,420) Mean Survival %
1	83.74	78.95	82.94	81.92
5	67.18	62.49	68.94	68.83
10	51.97	47.53	51.79	52.08
15	<u>33.19</u>	29.63	35.37	<u>37.05</u>

Best outcomes: female-to-female and male-to-male

Kaczmarek et al., "Gender Does Matter: Gender-Specific Outcome Analysis of 67,855 Heart Transplants," *Thorac Cardiovasc Surg*, 2013.

Definition of Terms

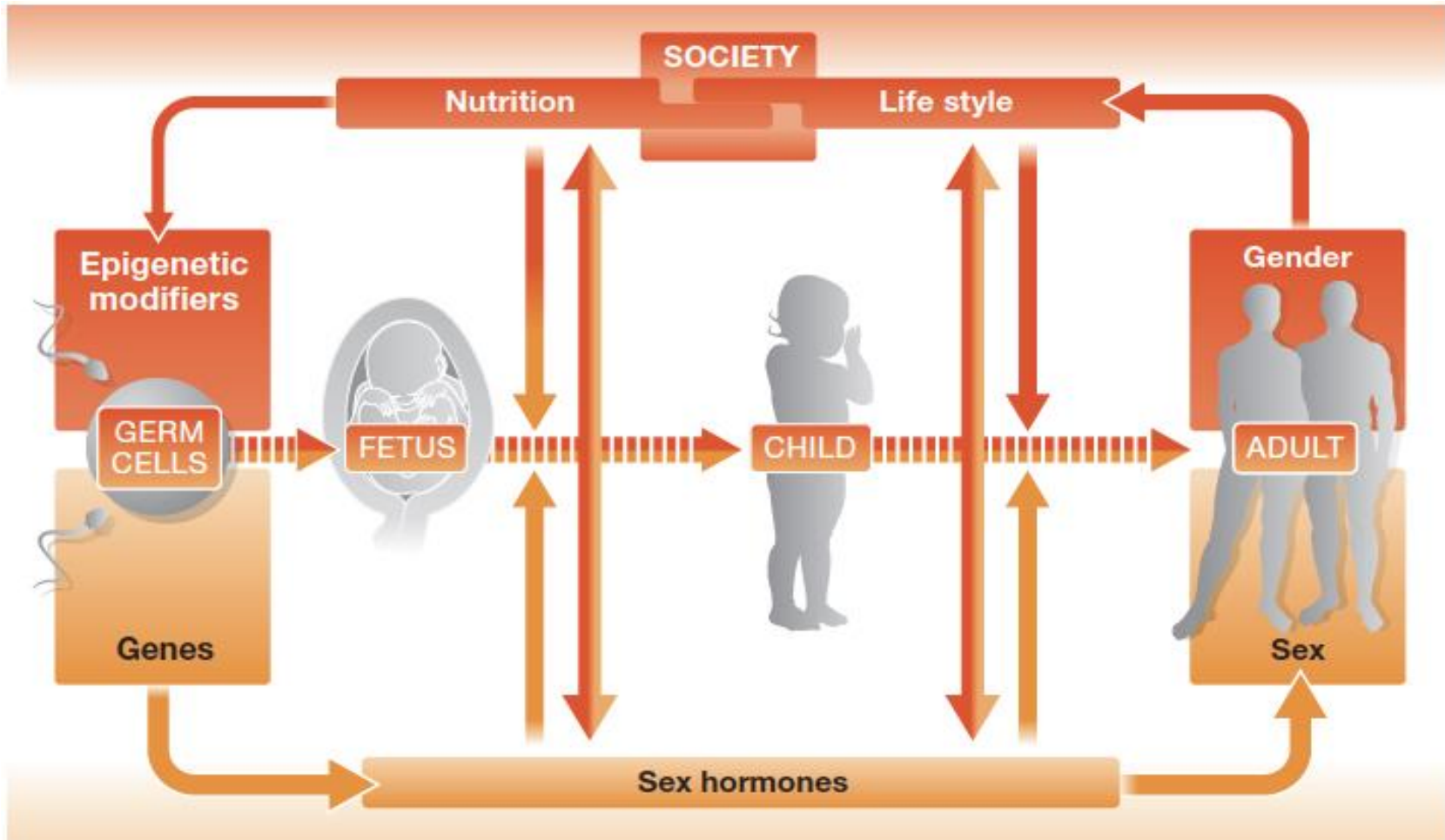
SEX = biological characteristics

GENDER = cultural attitudes and behaviors



Sex and Gender Interact

Regitz-Zagrosek, V. (2012). Sex and Gender Differences in Health. *EMBO Reports*, 13 (7): 596-603.



DANGER!

- ▶ That PIs confound sex with gender
- ▶ That PIs “see” sex (or a biological trait), when they are really looking at “gender” (or an environmental condition that may impact male and female animals differently).
- ▶ Schiebinger, Londa, Seth S. Leopold, and Virginia M. Miller. "Editorial policies for sex and gender analysis." *The Lancet* 388.10062 (2016): 2841–2842.

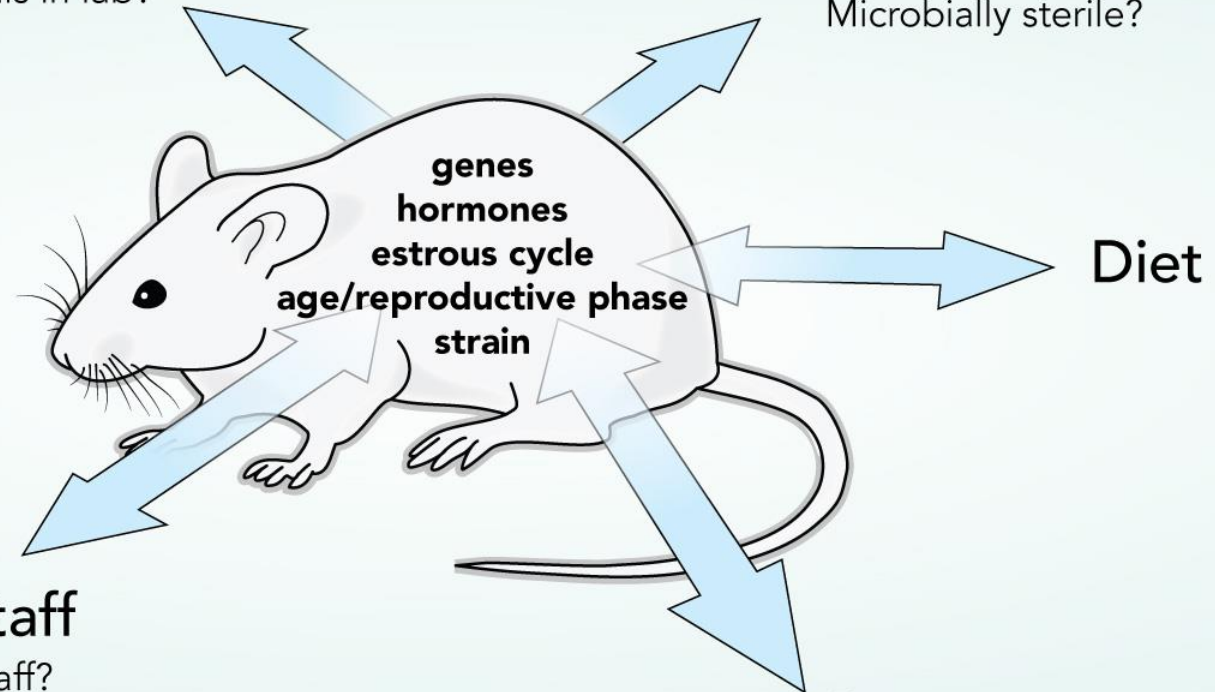
Integrating Sex & Gender into Animal Research

Social Dynamics

Sex-segregated or male/female mix?
Number and mix of animals in lab?

Caging

Individual or group? Size?
Complex environment vs. no enrichment?
Microbially sterile?



Diet

Researcher/Staff

Sex of researcher/staff?
Research/staff handling of
male/female animals?

Room

Temperature?
Sound?
Lighting (circadian)?
Odor?

Cost?

- ▶ From the NSF-funded Stanford workshop on Animal Research: Klein, S. L., Schiebinger, L., Stefanick, M. L., Cahill, L., Danska, J., de Vries, G. J., ... & Zucker, I. (2015). Opinion: Sex inclusion in basic research drives discovery. *Proceedings of the National Academy of Sciences*, 112(17), 5257-5258.

Gender in Heart Disease

- ▶ Can we reduce gender to variables so that results can be manipulated statistically?

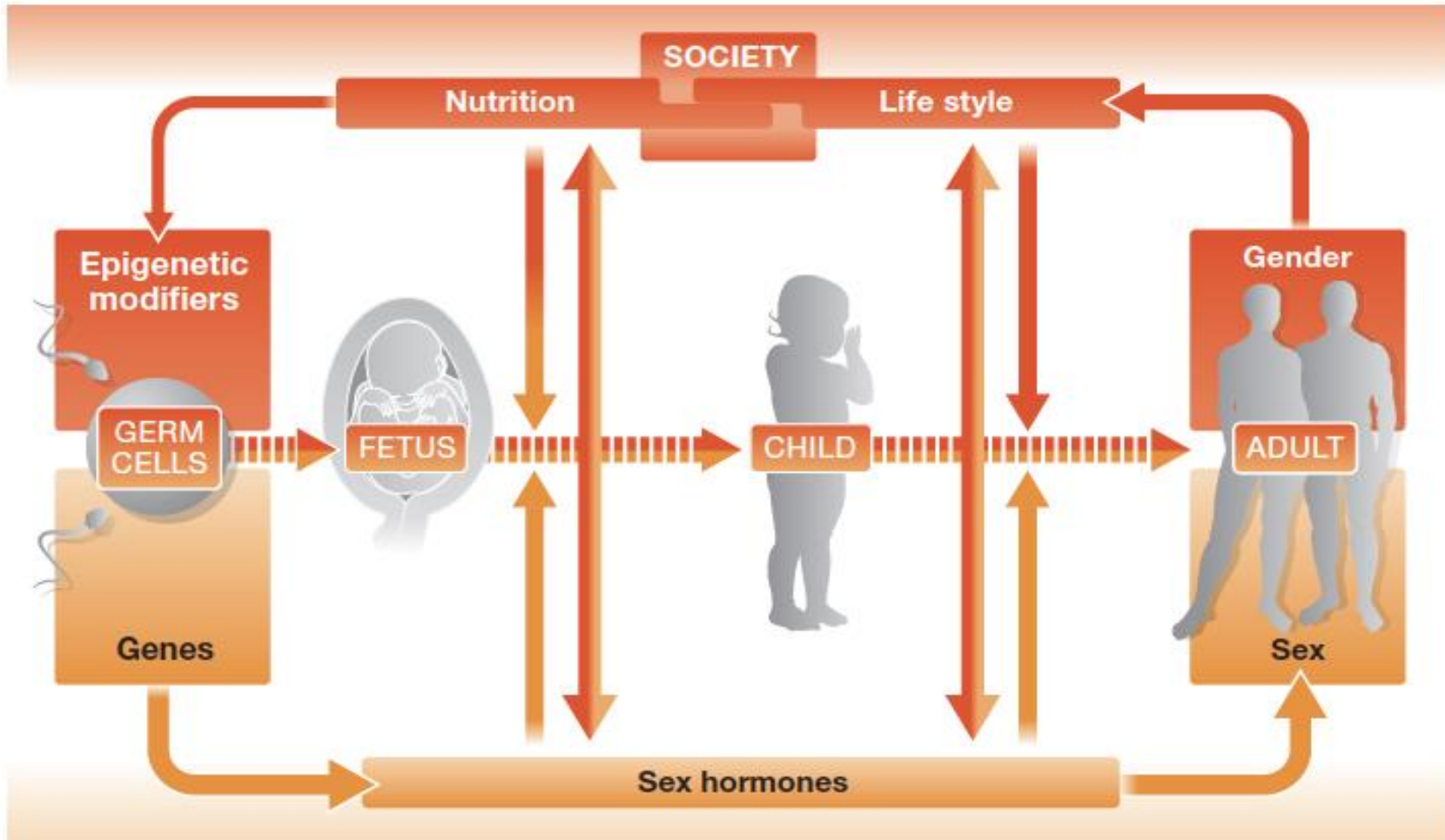
Gender Variables in Health Research

► Inspiration from Canada

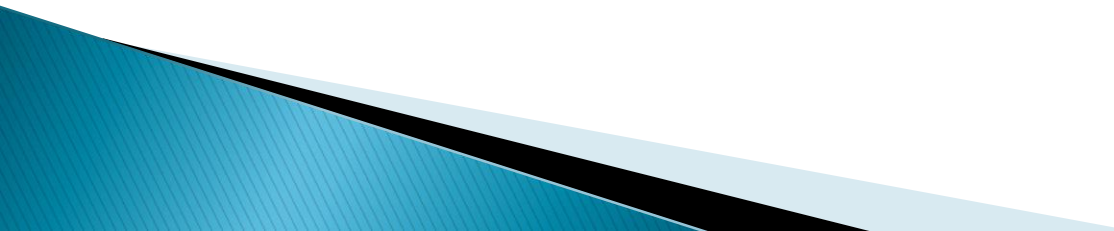
Pelletier, R., Khan, N. A., Cox, J., Daskalopoulou, S. S., Eisenberg, M. J., Bacon, S. L., ... & Norris, C. M. (2016). Sex versus Gender-Related Characteristics: Which Predicts Outcome After Acute Coronary Syndrome in the Young?. *Journal of the American College of Cardiology*, 67 (2), 127–135.

Sex and Gender Interact

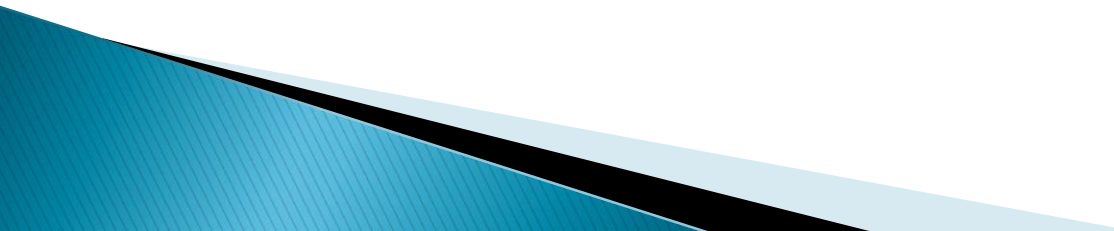
Regitz-Zagrosek, V. (2012). Sex and Gender Differences in Health. *EMBO Reports*, 13 (7): 596-603.



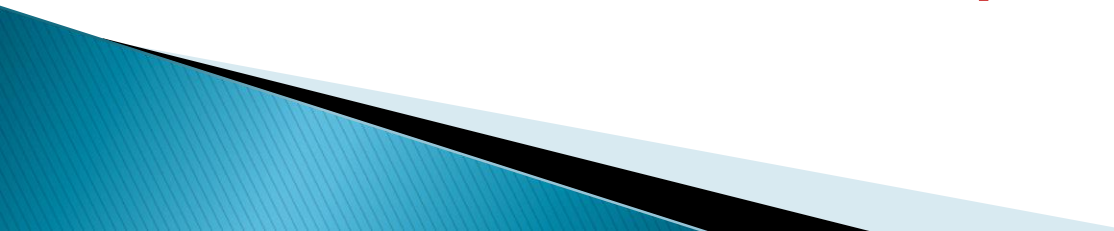
Seven Relevant Gender Factors

- household primary earner
 - personal income
 - number of hours per week spent doing housework
 - status of primary person responsible for doing housework
 - level of stress at home
 - Bem Sex Role Inventory masculinity score
 - Bem Sex Role Inventory femininity score
- 

Acute Coronary Syndrome (aged 55 and younger)

- ▶ No sex difference
 - ▶ Gender matters. Patients received a “gender-related score” of between 1 and 100. Patients with a higher “femininity” score—regardless whether they were men or women—were more likely to experience a recurrence of ACS.
- 

No longer valid

- household primary earner
 - personal income
 - number of hours per week spent doing housework
 - status of primary person responsible for doing housework
 - level of stress at home
 - **Bem Sex Role Inventory masculinity score**
 - **Bem Sex Role Inventory femininity score**
- 

Stanford Study

- ▶ Gender Variables in Health Research

Hoping for results in July

- ▶ Londa Schiebinger, **Mathias Wullum Nielsen**, Claudette Brooks, Mark R. Cullen, Gillian Einstein, John P.A. Ioannidis, Ineke Klinge, Hannah LeBlanc, Torsten B. Neilands, **Hee Young Paik**, Diana Peragine, **Louise Pilote**, Judith Prochaska, Stephen Ristvedt, Kierstyn Smith, Yoonju Song, Marcia L. Stefanick

Seed Grants:

- One example: <http://wsdm.stanford.edu/>

Research Resources:

- Gendered Innovations website.
genderedinnovations.stanford.edu
- March 2015: The EC Gender Advisory Group published an advice paper on preparing grants that integrate the gender dimension into research. <http://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetailDoc&id=18892&no=1>
- August 2015: The Canadian Institutes for Health Research rolled out the first of three trainings for Sex and Gender in Biomedical Research .
<http://www.discoversexandgender.ca/>

Research & Teaching Resources:

- Oertelt-Prigione, S.& Regitz-Zagrosek, V. (Eds.) (2012). *Sex and Gender Aspects in Clinical Medicine*.
- Regitz-Zagrosek, V., (Ed.) (2012). *Sex and Gender Differences in Pharmacology*.
- Schenck-Gustafsson, K., DeCola, P., Pfaff, D., Pisetsky, P. (Eds.) (2012). *Handbook of Clinical Gender Medicine*.

Curriculum

- Sex and Gender-Based Medical Education Summit - A Roadmap for Curricular Innovation, Mayo Clinic, US, October 2015 <https://ce.mayo.edu/special-topics-in-health-care/node/3095>
- Charité, Berlin: Ludwig, S., et al. (2015). A successful strategy to integrate sex and gender medicine into a newly developed medical curriculum. *Journal of Women's Health*, 24(12), 996-1005.

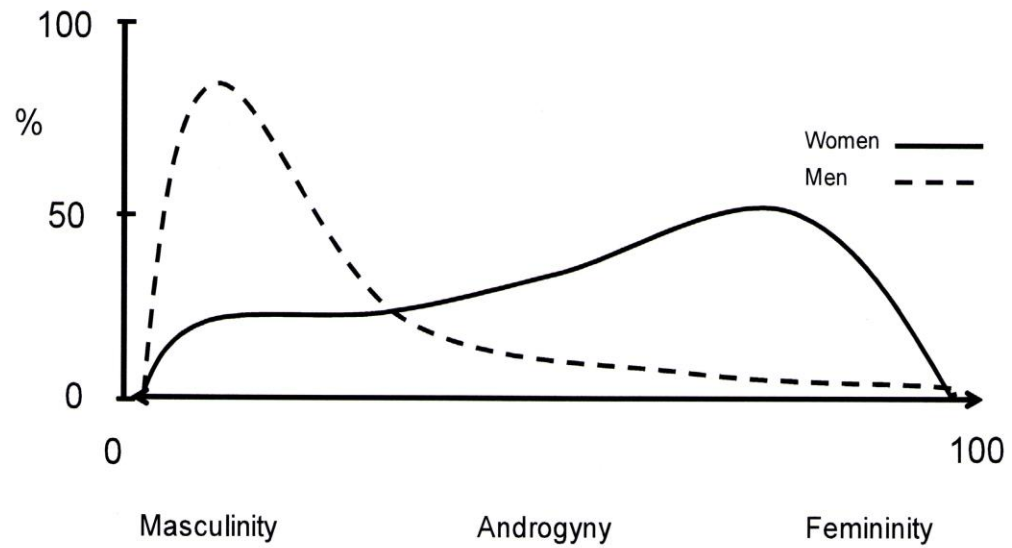
Join the Gendered Innovations listserv

- ▶ On the Gendered Innovations website, sign up at “Contact Us.”

Innovative Approaches

1. To move beyond binary notions of “masculinity” and “femininity.”
2. To capture three dimensions of gender:
 - Norms
 - Identity
 - Relations

APPENDIX C. Gender-related score distribution in men and women with premature acute coronary syndrome



Proposed Gender-Related Variables

Norms

- ▶ *Responsibility for Caregiving*
- ▶ *Time use*
- ▶ *Occupation*


Identity

- ▶ *Competitive*
- ▶ *Independent*
- ▶ *Risk-taking*
- ▶ *Communal*
- ▶ *Expressive*

Relations

- ▶ *Social support*
 - ▶ *Perceived discrimination*
 - ▶ *Quality of family relationships*
- 

Communal

- ▶ How often do you worry about what other people think about you?
 - ▶ When making an important decision in your personal life, how often do you take other peoples' needs into account?
 - ▶ How often do friends talk to you about their problems?
 - ▶ How easy is it for you to spot when someone in a group is feeling uncomfortable?
- 

Physician Gender Attitudes Interact with Patient Sex and Gender

